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Internet2 Demonstrates Interoperability of Multiple Dynamic Circuit Platforms at SC07 Lauren Rotman

- **From:** "Lauren Rotman" <lauren@internet2.edu>
- **To:** <i2-news@internet2.edu>
- **Subject:** Internet2 Demonstrates Interoperability of Multiple Dynamic Circuit Platforms at SC07
- **Date:** Tue, 13 Nov 2007 10:05:34 -0500
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Internet2 Demonstrates Interoperability of Multiple Dynamic Circuit Platforms at SC07

Interoperability to Facilitate Broad Adoption of Dynamic Circuit Platforms Worldwide

RENO, Nevada – November 13, 2007 – This week at SC07, the annual international conference on high performance computing, networking, storage, and analysis, Internet2, together with several partners and collaborators, will demonstrate for the first time interoperability of its revolutionary Dynamic Circuit (DC) Network with multiple regional and international networks as well as an equipment provider. The demonstration marks a milestone in facilitating the widespread adoption of dynamic circuit networking by showcasing how networks with different equipment, network technology, and allocation models can dynamically provision dedicated circuits across domains.

Dynamic circuit networks provide on-demand or scheduled dedicated point-to-point bandwidth to enable the most demanding applications for

research and education—including massive terabyte-sized data transfers and super high-definition video. In contrast, traditional IP (Internet Protocol) networks share network capacity among all applications using the network, which means that demanding applications compete with others for a fixed amount of bandwidth.

The Internet2 demonstrations will showcase interoperability with ESnet, GÉANT2 in Europe, the Great Plains Network (GPN), GRNET in Greece, HEAnet in Ireland, Merit Network, Northern Crossroads (NoX), a Nortel Network based in Ottawa, Canada, the PIONIER network in Poland, and the Phosphorus testbed at the University of Amsterdam via SURFnet's NetherLight GLIF Open Lambda Exchange in Amsterdam.

"The Internet2 community has long understood the potential of dynamic circuits to support a wide range of demanding applications. In today's environment, these applications, driven by science and medicine, are global in nature, so interoperability of dynamic circuit platforms is critical to supporting their adoption," said Rick Summerhill, Internet2 chief technology officer. "Creating standardized protocols to link optical networks across domains is a major step toward creating a ubiquitous dynamic circuit infrastructure that can seamlessly support the research of today, and of the future."

The Internet2 Dynamic Circuit (DC) Network, unveiled earlier this year, is a nationwide optical circuit network that provides short term, on-demand access to dedicated bandwidth up to 10 Gbps to serve the most demanding network applications like those involved in high-energy physics research, telemedicine and radio astronomy. The Internet2 DC Network uses standards-based technologies and protocols developed by its members and partners to provide dedicated optical paths anywhere and at any time a researcher, scientist or other potential user may need it.

For instance, in the near future, 8000 physicists worldwide will participate in the Large Hadron Collider (LHC) experimentation operated out of CERN in Geneva, Switzerland. When operations begin in 2008, LHC will produce multiple Petabytes of data annually for scientists to access and analyze. Dynamic circuit networks worldwide will play a critical role in supporting the high bandwidth data storage and data transmission requirements of the participating researchers.

The interoperability of the Internet2 DC Network with other dynamic circuit networks is enabled by the Inter-Domain Controller (IDC) protocol developed in a collaboration by GÉANT2, Internet2, and ESnet and is used widely in this community as the standard for interoperable dynamic circuit networking today. The University of Amsterdam is working to extend the protocol and other collaborators are expected to participate in further development as well.

The demonstrations will be showcased continuously from November 12th – 16th at the Reno-Sparks Convention Center. For more information on Internet2 at SC07, visit: <http://events.internet2.edu/2007/sc07/>.

Specifics of each interoperability demonstration include:

High Energy Physics

CERN's Large Hadron Collider (LHC) experiments are scheduled to produce their first data in mid-2008. This particular interoperability demonstration is in anticipation of the LHC data's intensive demands on the network from U.S. collaborators which includes 2 U.S. national laboratories; 15 Tier 2 institutions; 68 Tier 3 institutions; and the 1500 U.S. researchers participating in the experiments. The demonstration will showcase a large scale data set transfer between Fermilab, a Tier 1 national laboratory, and the University of Nebraska-Lincoln (UNL) a Tier 2 institution. The Fermilab and Caltech-developed LambdaStation control plane software will interact with the Internet2 DC Network and ESnet4 to invoke a dynamic circuit set up, creating a dedicated lightpath from UNL's network to GPN across the Internet2 DC Network through the ESnet4 infrastructure and then onto the Fermilab campus. In addition, Brookhaven National Laboratory (BNL), a LHC Tier 1 national laboratory, which developed the TeraPaths control software, will use the technology to create dedicated, QoS aware lightpaths from BNL, through ESnet and Internet2, to Boston University via NoX and the University of Michigan via the MiLR/Merit network.

European Multi-Domain Interoperability

Internet2 is working with its collaborators in the U.S. and Europe to develop and test common aspects of Inter-Domain Controller software. Internet2 will work with GÉANT2 (the European Research and Education Next Generation Network), HEAnet: Ireland's Research and Education Network, GRNET: Greece's Research and Education Network, PIONIER: Poland's Research and Education Network and Phosphorus: the EU testbed project for optical networking; to test the dynamic set up of optical circuits to locations in each of these regions. This interoperability testing will be supported on the European side by the AutoBAHN (Automated Bandwidth Allocation across Heterogeneous Networks) architecture developed within the GÉANT2 project. AutoBAHN enables the dynamic provisioning of user-requested network circuits upon demand over multiple networks implemented using different technologies and provisioning policies. High definition video streaming and large file transfer applications will be initiated from the Internet2 booth to showcase the capabilities of the dynamic circuit network and its ability to support next-generation uses of the network.

Nortel Dynamic Resource Allocation Controller (DRAC) Interoperability

Nortel has a technology product called the Dynamic Resource Allocation Controller (DRAC) to address next-generation networking concerns around an application-aware dynamic network. Nortel in collaboration with Internet2 will demonstrate the deployment of the IDC protocol within the DRAC software, the first ever vendor implementation of the protocol. Nortel is planning to create an optical connection to Internet2 at Manhattan Landing exchange point (MAN LAN) in New York City via CANARIE. This path will be terminated at the SC07 showfloor in Reno with connectivity to both Nortel and Internet2 booths. At Nortel Labs, the connection will be terminated on its Metro Ethernet Routing Switch (MERS) 8600 Ethernet Switch and Optical

Multiservice Edge (OME) 6500 optical platform.

This demo shows the ability of the open source IDC implementation to interoperate with a commercial Network Domain Controller. It also highlights a proof point of Nortel's DRAC capabilities to participate in an inter-domain infrastructure, and further establishes the usefulness of the IDC protocol in enabling widespread adoption of dynamic networks. The expectation is that Nortel and other companies will participate in ongoing development of the protocol and will play an instrumental role in deployment of a global, dynamic, interoperable optical and Ethernet infrastructure.

In addition, the Nortel DRAC software will enable a conference floor demonstration by creating and releasing circuits between the Nortel booth and the Internet2 booth on the SC show floor. Using GridFTP, a performance optimized file transfer program for Grid environments included in the Globus Toolkit, a dataset consisting of medical data will be transferred over the application requested on-demand connection. The demo will effectively saturate the dedicated link, then the link will be taken down. The process will repeat at regular intervals for benefit of the show attendees.

The University of Amsterdam and CineGrid demonstration

The University of Amsterdam (UvA), together with SURFnet, one of the pioneers of hybrid networking, is collaborating with Internet2 to develop and implement inter-domain authorization between the Phosphorus testbed and Internet2's DC Network. UvA's Token Based Authorization concepts are introduced in the IDC protocol and software to enable secure authorized access of lightpaths and video content across multiple domains. Using this technology UvA will stream on demand CineGrid 1080p HD video from the University of Amsterdam across SURFnet, NetherLight and Internet2 networks terminating at the Dutch Pavilion at the SC07 conference. Using dynamically authorized Gigabit optical paths, researchers will stream video from Amsterdam to the booth at an average 300 MBit/s bitrate showing extraordinary quality at full frame rate provided by the predictable configurable Lightpath networks. For more info please see:

<http://www.science.uva.nl/~delaat/sc07>

About Internet2(R)

Internet2 is the foremost U.S. advanced networking consortium. Led by the research and education community since 1996, Internet2 promotes the missions of its members by providing both leading-edge network capabilities and unique partnership opportunities that together facilitate the development, deployment and use of revolutionary Internet technologies. Internet2 brings the U.S. research and academic community together with technology leaders from industry, government and the international community to undertake collaborative efforts that have a fundamental impact on tomorrow's Internet. For more information: <http://www.internet2.edu>

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